Neo-vaginal Advancement Flaps in the Treatment of Urethral Strictures in Transwomen

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OBJECTIVES	To explore the use of neo-vaginal advancement flaps in the treatment of distal urethral strictures with description of the techniques and preliminary results in transwomen.
METHODS	Five patients were treated. A 7-flap was used in 2 patients and an inverted U-flap in 3 patients. In 1 patient with an inverted U-flap, the urethra was further enlarged using buccal mucosa because of Lichen Sclerosus. Three out of 5 patients already underwent previous interventions.
RESULTS	Median patient age was 67 years (range: 41-74) and median stricture length was 2.0 cm (range: 1.5-2.0). Median operation time was 41 minutes (range: 38-70). One low-grade complication (bladder spasms) was reported. No patient suffered a recurrence after a median follow-up of 37 months (range: 6-97). All patients were satisfied with the result.
CONCLUSION	Neo-vaginal advancement flaps can be safely used in transwomen with distal urethral strictures. The success rate and patient's satisfaction are encouraging. UROLOGY 129: 217−222, 2019. © 2019 Elsevier Inc.

The treatment of urethral strictures has always been a challenge to the reconstructive urologist. Great progress has been made in sex reassignment procedures for both transmen and transwomen. After phalloplasty and metadoioplasty, the risk of urethral stricture formation is high (25%-58%)[1] and its treatment is complex and rather disappointing.[2,3] In transwomen, strictures almost exclusively occur at the neomeatus and the incidence is about 5%,[4] although 1 study reported a 40% incidence.[5] Information about the treatment of strictures in transwomen is extremely scarce. In cisgender women, strictures are usually first treated with dilation or urethrotomy despite the disappointing results.[6] If this fails, different types of urethroplasty can be performed with substantially better results.[6] One type of urethroplasty is the use of local vaginal advancement flap.[7] We implemented this technique in the treatment of strictures in transwomen as well. The objective of this paper is to describe the indication, the technique and the surgical outcome of neo-vaginal advancement flaps to treat strictures in transwomen. To the best of our knowledge, this is the first paper to do so.

MATERIAL AND METHODS

Patient Selection

A database has been collected of all urethroplasties performed at Ghent University Hospital since 2001 (start of electronic medical file). Only 5 urethroplasties were performed on transwomen, which consists the current cohort. All 5 patients underwent penectomy and vaginoplasty using the penoscrotal inverted skin flap.[8] All patients presented with weakened urinary stream and at least 1 episode of urinary tract infection. In 2 patients, a suprapubic catheter was inserted because of retention. Pain on micturition was another complaint in 3 patients. In 1 patient, Lichen Sclerosus (LS) was clearly present at the neomeatus and surrounding neo-vaginal skin on clinical examination. Diagnosis was confirmed by voiding cysto-urethrography in all patients. If no suprapubic catheter was present, a 5 Fr feeding tube was passed through the urethra into the bladder to fill the bladder with contrast medium. A urine culture was performed 1 week before surgery and antibiotics according to the antibiogram were started in case of infection 1 day before surgery.

Surgical Technique

All operations were performed by the same surgeon (N.L.). The patients were placed in lithotomy position with the hips and knees in 90° flexion and the legs in 45° abduction. The feet and calves were placed in supportive boots. If a suprapubic catheter was present, the bladder was filled with 100 mL of diluted povidone-iodine solution. Povidone-iodine solution was also used to disinfect the surgical field. The vestibulum, neomeatus, and neo-vagina were exposed using a Lone Star retractor (CooperSurgical, CT) with the hooks at the labia minora and with a vaginal blade to retract the posterior vaginal wall. A 3 Fr ureteric catheter was placed through the urethra up to the bladder as guidewire.

In 3 patients, an *inverted U-incision* was made at the anterior vaginal wall with the tip at the neomeatus (Fig. 1). The dimensions of incision were 3.0-4.0 cm in length and 2.5-3.0 cm in width. A plane of dissection was followed along the ventral surface of the corpus spongiosum and urethra in order to preserve the vascularization of the neo-vaginal flap which consists of the previous penile dartos layer. The urethra was opened ventrally from the neomeatus following the guidewire until healthy proximal urethra was encountered. This must allow passage of a 20 Fr urethral catheter. Stay sutures (silk 3.0) were placed at the edges of the opened urethra to facilitate exposure. In the one patient with LS, the dorsal urethral plate was incised over 3.0 cm and the dorsal edges were mobilized. A buccal mucosa graft of 3.0 × 2.0 cm was harvested, defatted, meshed, and sutured at the defect in the dorsal urethral plate using Monocryl (Ethicon, NJ) 4.0 running suture on both sides. The graft was further quilted to the graft bed with Monocryl 4.0. The tip of the U-flap is sutured to the most proximal part of the opened urethra with Monocryl 4.0. The edges of the U-flap are further sutured to the urethral edges with interrupted sutures Monocryl 4.0 from proximal to distal up to the level of the meatus. The underlying spongious tissue was incorporated into these sutures to reduce bleeding from the spongiosum. The base of the flap is sutured to the remaining neo-vaginal skin opening with Vicryl rapide (Ethicon, NJ) 3.0.
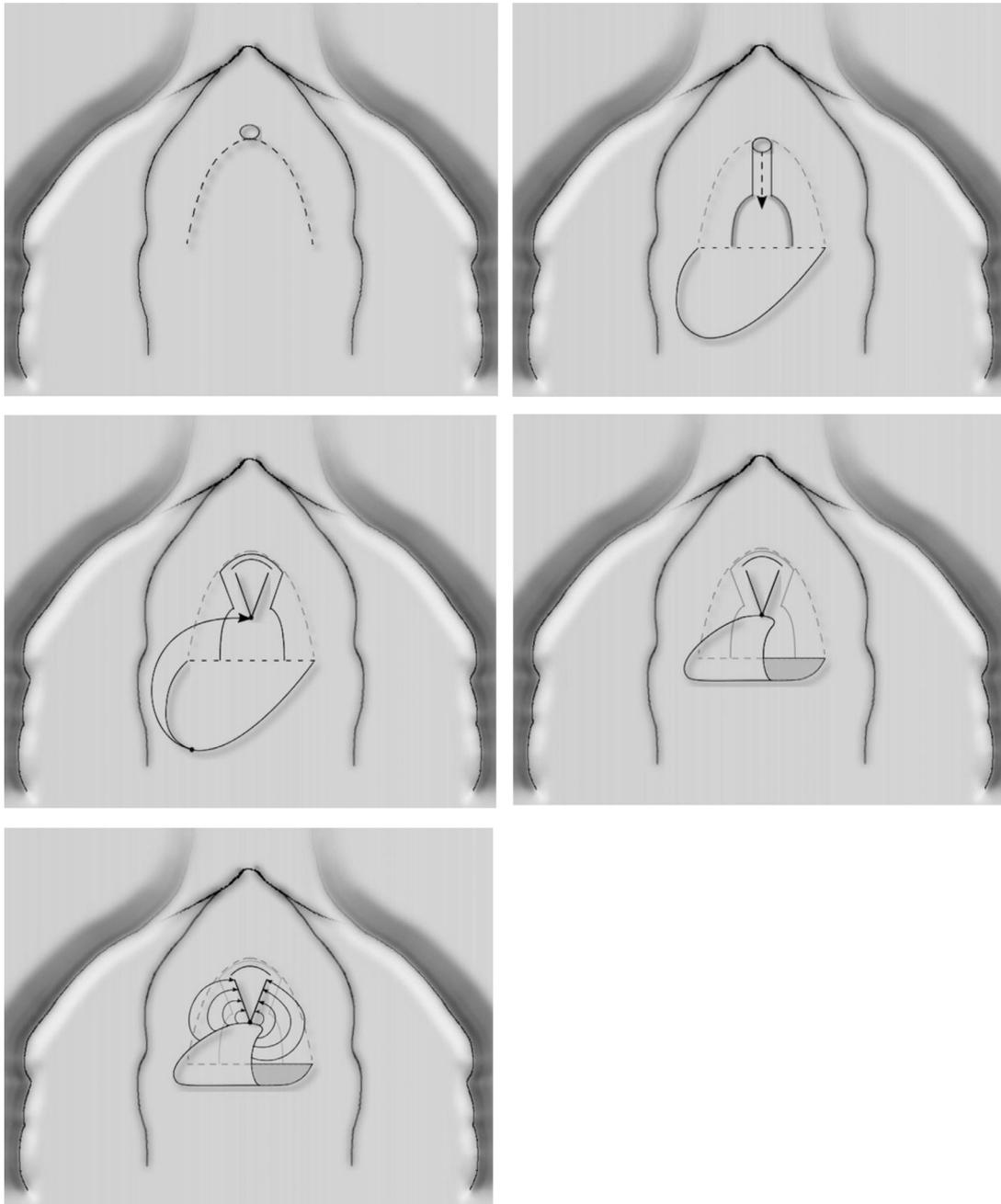

Figure 1. Inverted U-flap. Inverted U-incision at the anterior neo-vaginal wall (upper left). Ventrally opened urethra (upper right). Suturing the tip of the U-flap to the most proximal part of the opened urethra (middle row). Suturing the edges of the U-flap to the urethral edges from proximal to distal (lowest row).

In 2 patients, a midline incision was made at the anterior vaginal wall and ventral urethra from the neomeatus and prolonged to proximal following the guidewire until healthy urethra was identified. Again, stay sutures (silk 3.0) were placed to expose the urethral edges. A *7-flap* was created according to the dimensions of the opened urethra (Fig. 2). At the level of the neomeatus (which is the distal end of the midline neo-vaginal incision), a horizontal incision toward right was made over 2.0 cm followed by a vertical incision to proximal over 2.5 cm at the lateral neo-vaginal wall. The flap was mobilized respecting the underlying dartos layer to preserve its vascularization. The tip of the flap was sutured to the most proximal part of the opened urethra as described above. The edges of the flap were sutured to the edges of the urethra from proximal to distal with interrupted Monocryl

4.0 sutures again incorporating the opened spongious tissue for hemostatic reasons. The remains of the flap were sutured to the neo-vaginal wall with Vicryl rapide 3.0.

A 20 Fr urethral catheter was placed in all patients. After discharge and catheter removal (upon clinical condition and preference of the patient), patients were followed after 3 months, 1 year, and annually thereafter. Follow-up visits included history taking, clinical examination, uroflowmetry, and ultrasonic residual volume measurement. Although no validated questionnaires were used, we specifically asked for spraying (including inward deflection of the urinary stream), painful micturition, and urinary incontinence during the postoperative visits. Additional imaging was performed in case of obstructive symptoms, urinary tract infection and/or
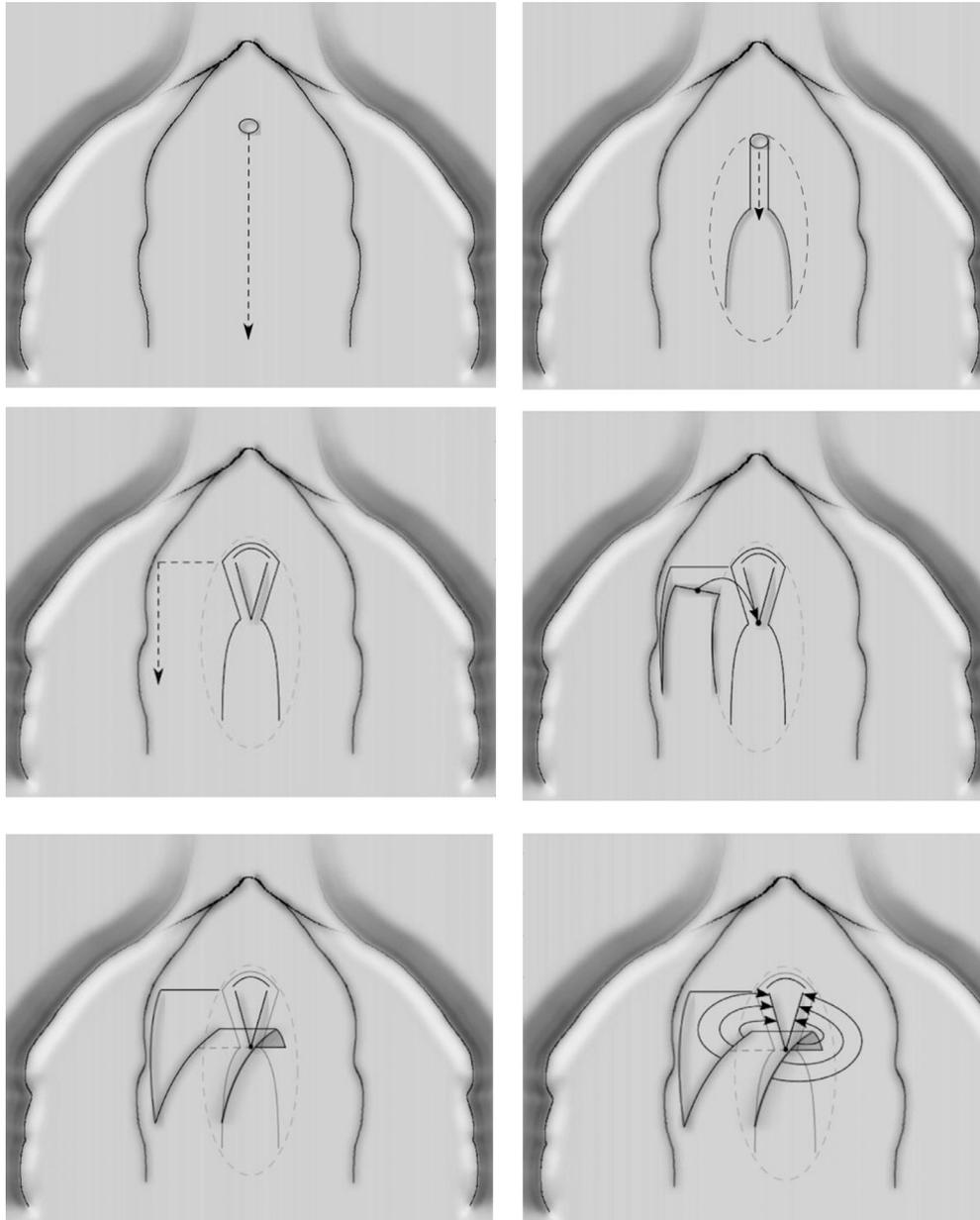

Figure 2. 7-flap. (A) Midline incision at the anterior neo-vaginal wall (upper left). Ventrally opened urethra (upper right). Horizontal incision toward left and a vertical incision to proximal at the lateral neo-vaginal wall (middle left). Suturing the tip of the 7-flap to the most proximal part of the opened urethra (middle right, lower left). Suturing the edges of the 7-flap to the urethral edges from proximal to distal (lower right).

maximum urinary flow <15 mL/s. A functional definition of failure was used: "need for a secondary procedure (including single dilation)."[9]

Statistical Analysis and Ethics

Descriptive statistics were used to define the study population. The median is reported with range. Tests were performed using IBM SPSS software version 25.0. The study was approved by the local ethics committee (EC UZG 2008/234) and written informed consent was obtained (Table 1).

RESULTS

Median age was 67 (range: 41-74) years. The stricture was located at the distal urethra and neomeatus in all patients. voiding cysto-urethrography clearly showed a prestenotic urethral dilation with an abrupt transition at the narrowed segment (Fig. 3). The exact stricture length is not easy to measure preoperatively. Previous interventions included dilations in 2 patients and urethroplasty combined with dilations in 1 patient. Median time between vaginoplasty and urethroplasty was 249 (range: 47-473) months. Urinary infection was present in the 2 patients with a suprapubic catheter. Median operation time was 41 (38-70) minutes. Median stricture length, measured peroperatively, was 2.0 (range: 1.5-2.0) cm. Median hospital stay was 2 (1-4) days. Median duration of catheterization was 8 (4-16) days. One complication (grade 2), bladder spasms with need for anticholinergic drugs, was noted postoperatively. Median follow-up was 37 (6-97) months. One patient had a postoperative maximum urinary flow of 10.5 mL/s but cystoscopy revealed no stricture recurrence. None of the patients suffered a stricture recurrence. In addition, none of the patients complained of incontinence, spraying, inward deflected urinary stream or painful micturition during the postoperative visits. All patients stated to be very satisfied with the surgery.

COMMENT

In a 17-year period of registration, only 5 transwomen were treated with urethroplasty despite the fact that vaginoplasty is performed at Ghent University Hospital on a weekly base with currently about 1000 vaginoplasties performed in transwomen. This suggests that, as opposed to transmen,[4] urethral strictures in transwomen are rare. This finding tends to confirm the 1%-5% stricture incidence reported in the systematic review of Horbach et al.[4] This is in contrast to the 40% incidence in the study of Rossi et al.[5] We have no clear explanation for this discrepancy. Rossi et al reported "obstructive voiding disorder" as reason for VY-plasty for a stricture at the neomeatus. Symptoms ranged from subjective obstructive voiding symptoms to retention. It is possible that some of these patients only had a low-grade stricture which has not been treated by urethroplasty in other series. A weaker stream after vaginoplasty was reported during patient interview in 19% in the series of Hoebeke et al but no information is present whether they were investigated for urethral stricture.[10] Our database cannot retrieve the number of transwomen treated with dilation or internal urethrotomy, nor the amount of patients treated with

Table 1. Patient characteristics and surgical outcomes

| Patient	Age (y)	Time Between Vaginoplasty and Urethroplasty (mo)	Pevious Interventions	Type of Urethroplasty	Stricture Length (cm)	Operation Time (min)	Hospital Stay (d)	Catheterisation (d)	Complications	Follow-up (mo)	Postoperative Qmax (mL/s)	Failure
1	41	249	Single dilation	7-flap	2	41	2	5	None	97	24	No
2	67	473	Multiple dilations	7-flap	2	55	4	4	None	53	36	No
3	70	47	None	⋂-flap	2	40	1	8	None	37	16,6	No
4	74	301	Urethroplasty + multiple dilations	⋂-flap + buccal mucosa graft dorsal inlay	1.5	70	2	9	None	9	10,5	No
5	49	65	None	⋂-flap	1.5	38	2	16	Bladder spasms	6	28	No
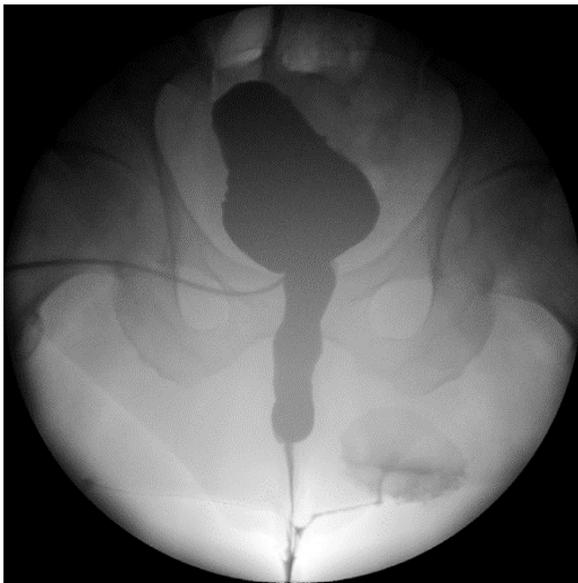
Figure 3. Voiding cysto-urethrography of neomeatal stricture demonstrating ballooning of the proximal urethra.

urethroplasty elsewhere. So the true stricture incidence might be higher.

We noted a long time interval (at least 47 months) between vaginoplasty and urethroplasty and a relatively high age at the moment of urethroplasty. Atrophy of the genital skin might be an explanation for this. In 1 patient, LS was observed (and confirmed by pathology report). LS is an inflammatory disease affecting the genital skin and urethra and an important etiology of stricture formation.[11] As the neo-vagina and vestibulum consist of penile and scrotal skin, transwomen might develop LS as well. In the 4 other patients, no tissue for pathologic examination was retrieved, so it could have been missed here.

Treatment of urethral strictures has been poorly described in transwomen. In cisgender men, cisgender women, and transmen, treatment options include dilation, internal urethrotomy, and different types of urethroplasty. The long-term results of dilation and internal urethrotomy are inferior to those of urethroplasty in cisgender males[12] and females.[6] It is very likely that in transwomen, the result of dilation and internal urethrotomy are inferior to urethroplasty as well, however, we have no hard evidence to support this. The present series show an excellent success rate of urethroplasty with 60% of patients already being treated with dilation(s). At present, no results are published regarding the outcome of dilation or internal urethrotomy in transwomen. Data on results of urethroplasty in transwomen are very scarce as well. Kwum Kim et al treated 2 patients with obstruction at the neomeatus successfully by excision and direct closure. No further technical details are provided in this series.[13] Rossi et al initially treated 132 patients with meatal stenosis by VY-plasty. This technique is based on the Heineke-Mikulicz principle performing a ventral longitudinal incision at the meatus with horizontal closure, as described in females.[14,15] Further surgery for stricture recurrence was needed in 15% of patients.[5] This

technique is only possible for short (<1 cm) meatal strictures as it would result in a hypospadiac meatus with spraying and vaginal voiding in longer strictures.[15] We planned to do this technique in 2 patients and started with a ventral longitudinal incision at the meatus. However, the stricture appeared to be too long for simple VY-plasty. Therefore, we used a 7-flap as described in perineal urethrostomy.[16] This 7-flap is a good solution if no inverted U-incision has been made upfront. Basically, the principle of the neo-vaginal advancement flap is the same with both the 7- and inverted U-flap. In female urethroplasty, a vestibular flap using the "7-principle" as well has been described with 88% success rate.[17] The inverted U-flap has been used in female urethroplasty with an 80%-100% success rate. The results of vaginal advancement flaps in female urethroplasty are thus in line with the present results in transwomen. Although theoretically, there is also risk of an inward deflection of the urinary stream and spraying with a vaginal advancement flap,[18] this has not been reported by our patients. In 1 patient, we opted to further enlarge the meatus with a dorsally placed buccal mucosa graft. As there was apparent LS, we opted for buccal mucosa as this is more resistant against LS compared to genital skin.[11] Indeed, the neo-vaginal advancement flap basically consists of genital skin and might become affected by LS as well.[11] This was inspired by the series of Kamat, although there it was in a cloverleaf configuration.[19] In their series, buccal mucosa was used in 4 patients to enlarge the stenotic meatus of perineal urethrostomy caused by LS with success in 3 patients.[19]

This series has several limitations. It is a retrospective series with a very limited number of patients. The follow-up is still rather short. It is possible that, with longer follow-up, the results will deteriorate as reported previously for substitution urethroplasty.[20] A functional definition of failure has been used although an anatomical definition is more objective.[9] No comparison has been made with other techniques. No standardized or validated questionnaires were used in the evaluation of these patients. These questionnaires should be ideally designed as patient reported outcome measures (PROMs). These PROMs should include a comprehensive functional evaluation (obstructive and irritative voiding symptoms, urinary continence, sexual function), aesthetic evaluation and an evaluation of the patient's quality of life which is finally of utmost importance. At the moment, several PROMs are available, but unfortunately none of them have been validated in cisgender or transgender women.[21]

CONCLUSION

This preliminary report on the use of neo-vaginal advancement flaps shows good results and high satisfaction for the treatment of distal urethral strictures in transwomen. It can be considered as a valuable treatment option in these patients, but it must be evaluated prospectively and compared with other techniques in the future.

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